

REMARKS

I. Introduction

By the present Amendment, claims 1, 9, and 12 have been amended. Claims 17 and 18 have been cancelled. Accordingly, claims 1-6, 9-16, and 19-21 remain pending in the application.

II. Office Action Summary

In the Office Action of February 9, 2006, claims 1, 2, 10-13, 16, and 17 were rejected under 35 USC §102(b) as being anticipated by U.S. Patent No. 6,344,790 issued to Ochi et al. ("Ochi"). Claims 3, 5, 9, 14, and 15 were rejected under 35 USC §103(a) as being unpatentable over Ochi in view of U.S. Patent No. 4,042,951 issued to Robinson et al. ("Robinson"). Claims 5 and 21 were rejected under 35 USC §103(a) as being unpatentable over Ochi in view of Robinson, and further in view of U.S. Patent No. 6,137,211 issued to Sugimoto et al. ("Sugimoto"). Claim 6 was rejected under 35 USC §103(a) as being unpatentable over Ochi in view of Sugimoto. Claim 18 was rejected under 35 USC §103(a) as being unpatentable over Ochi in view of U.S. Patent No. 5,372,886 issued to Inazawa et al. ("Inazawa"). Claims 19 and 20 were rejected under 35 USC §103(a) as being unpatentable over Ochi in view of U.S. Patent No. 4,742,377 issued to Einthoven. The cancellation of claims 17 and 18 renders part of these grounds of rejection moot. Regarding the remaining claims, these rejections are respectfully traversed.

III. Rejections under 35 USC §102(b)

Claims 1, 2, 10-13, 16, and 17 were rejected under 35 USC §102(b) as being anticipated by Ochi. Regarding independent claim 1, the Office Action alleges that

Ochi discloses a device that includes first and second electrodes having layers containing copper as main components, a semiconductor element arranged between the first and second electrodes and electrically connected thereto, and a glass sealing member which seals the first electrode, the semiconductor element, and the second electrode. The Office Action further alleges that in the first and second electrodes, ratios of the layers containing copper as main components are not less than 20 wt%. Applicants respectfully disagree.

As amended, independent claim 1 provides a semiconductor device that comprises:

first and second electrodes having layers containing copper as main components;

a semiconductor element arranged between said first and second electrodes and electrically connected to said first and second electrodes; and

a glass sealing member which seals said first electrode, said semiconductor element, and said second electrode,

wherein, in the first and second electrodes, ratios of the layers containing copper as main components are more than 20 wt%,

said first and second electrodes have copper oxide layers formed on the outer peripheries of said layers containing copper as main components, the copper oxide layers contacting with said glass sealing member, and

the thickness of said copper oxide layers is 1.5 μm or less at the time before said first and second electrodes are glass-sealed.

The semiconductor device of independent claim 1 includes first and second electrodes that have layers containing copper as the main components. A semiconductor element is arranged between the first and second electrodes and electrically connected to the first and second electrodes. A glass sealing member is provided to seal the first electrode, the semiconductor element, and the second

electrode. Ratios of the layers containing copper as the main components in the first and second electrodes are more than 20 wt%. The first and second electrodes have copper oxide layers formed on the outer peripheries of the layers containing copper as main components and the copper oxide layers contacting with the glass sealing member. Furthermore, the thickness of the copper oxide layers is 1.5 μm or less at the time before the first and second electrodes are glass sealed. At least one benefit achieved by the invention of independent claim 1 is that the level of adhesiveness between the glass sealing member and the first and second electrodes can be improved. Accordingly, it is further possible to improve the level of tension which the components can withstand.

In contrast to the claimed invention, Ochi discloses a structure in which a temperature sensitive resistor, such as a thermistor, is sealed in a glass sealing member. See column 3, lines 26-33. The electronic device of Ochi is configured such that the thermistor is sealed within the glass sealing member and the Dumet wires sandwich and contact the thermistor from both sides. See Fig. 4. Ochi provides a Dumet wire containing a core wire (11) made of iron-nickel alloy coated by an intermediate layer formed of copper (12). The intermediate layer is further covered by a layer of copper oxide (13). Ochi provides no additional disclosure or suggestion which relates to the thickness of the layers of the Dumet wire. Ochi simply fails to provide any disclosure for features recited in independent claim 1, such as:

said first and second electrodes have copper oxide layers formed on the outer peripheries of said layers containing copper as main components, the copper oxide layers contracting with said glass scaling member, and

the thickness of said copper oxide layers is 1.5 µm or less at the time before said first and second electrodes are glass-sealed.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Claims 2-6, 8-16, and 19-21 depend, either directly or indirectly, from independent claim 1, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

IV. Rejections under 35 USC §103(a)

Claims 3, 5, 9, 14, and 15 were rejected under 35 USC §103(a) as being unpatentable over Ochi in view of Robinson. Regarding this rejection, the Office Action alleges that Ochi discloses all the limitations recited in independent claim 1. Robinson is relied upon for disclosing the additional features recited in these claims. This does not appear to be the case.

As to the requirements for sustaining a rejection under 35 U.S.C. §103, the Federal Circuit and the M.P.E.P. have indicated a *prima facie* case of obviousness requires that three basic criteria be met. First, there must be some suggestion or motivation in the primary reference to modify, combine, or seek out the teachings of a secondary reference. Second, there must be a realistic expectation of success from combining the two references. Finally, the prior art references must clearly teach or suggest all the claim limitations. See M.P.E.P. §706.02(j). The Federal Circuit has consistently supported the requirements of the M.P.E.P. in stating, for example, that “[i]n proceedings before the Patent and Trademark Office, the

Examiner bears the burden of establishing a *prima facie* case of obviousness based upon the prior art." *In re Fritch*, 972 F.2d 1260, 23 USPQ 2d 1780 (Fed. Cir. 1992).

In the decision of *In re Fine*, 5 USPQ 2d 1596 (Fed. Cir. 1988), the court pointed out that the PTO has the burden under '103 to establish a *prima facie* case of obviousness and can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. As noted by the court, whether a particular combination might be "obvious to try" is not a legitimate test of patentability and obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. The teachings of the prior art must be examined objectively, and not in view of the claimed invention. As further noted by the court, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

Furthermore, such requirements have been clarified in the decision of *In re Lee*, 61 USPQ 2d 1430 (Fed. Cir. 2002) wherein the court, in reversing an obviousness rejection, indicated that deficiencies of the cited references cannot be remedied with conclusions about what is "basic knowledge" or "common knowledge". The court pointed out:

The Examiner's conclusory statements that "the demonstration mode is just a programmable feature which can be used in many different device[s] for providing automatic introduction by adding the proper programming software" and that "another motivation would be that the automatic demonstration mode is user friendly and it functions as a tutorial" do not adequately address the issue of motivation to combine. This factual question of motivation is immaterial to patentability, and could not be resolved on subjected belief and unknown authority. It is

improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher."... Thus, the Board must not only assure that the requisite findings are made, based on evidence of record, but must also explain the reasoning by which the findings are deemed to support the agency's conclusion. (emphasis added)

As discussed above with respect to independent claim1, Ochi fails to disclose features that are recited in the claims. Additionally, these features are not suggested by Ochi in any way. The inclusion of Robinson as a secondary reference does not remedy this situation, because Robinson also fails to provide any disclosure or suggestion for the features that are lacking in Ochi. Accordingly, these claims are believed allowable over the combination of Ochi and Robinson.

Notwithstanding the failure of these references to disclose or suggest features recited in independent claim 1, these claims further recite features that are not shown or suggested by the art of record. For example, claim 9 provides that the semiconductor element has a bump electrode and the thickness of the layers containing copper as the main components formed around the core portions are larger than the height of the bump electrode. The Office Action alleges that Robinson discloses a semiconductor element having a bump electrode wherein the thickness of copper containing layers is larger than the thickness of the bump electrode. Applicants' review of Robinson, however, has failed to provide any disclosure or suggestion for a relationship between the thickness of the copper layer and the height of the bump electrode. It is not clear how this silence can be equated as a disclosure of claimed features.

Based on the foregoing, it is respectfully submitted that claims 3, 5, 9, 14, and 15 are allowable over the art of record.

Claims 5 and 21 were rejected under 35 USC §103(a) as being unpatentable over Ochi in view of Robinson, and further in view of Sugimoto. Regarding this rejection, the Office Action alleges that Ochi discloses all the limitations of independent claim 1. Robinson is relied upon for teaching a semiconductor element with a metal electrode and a sealing temperature of the glass sealing member being a temperature at which silicification of the metal electrode is not enhanced. Sugimoto is relied upon for teaching a glass ceiling member which is softened and sealed at a temperate within the range of 500 °C to 1000 °C. Applicants respectfully disagree.

As previously discussed, Ochi and Robinson fail to provide any disclosure or suggestion for features recited in independent claim 1. Furthermore, these same features are not shown or suggested by Sugimoto. Sugimoto appears to disclose a glass seal for a spark plug which is used in internal combustion engine applications. Sugimoto discloses a structure in which a space between the center electrode and the terminal electrode is sealed by a glass seal, a resistor, and a metal glass in the spark plug. The sealing glass temperature is set to 500 °C to 1000 °C. However, Sugimoto fails to provide any disclosure or suggestion for the adhesive property of the copper and glass as set forth in the present claims. Sugimoto only discloses the sealing temperature of the insulator and the glass and does not provide any suggestion for the adhesive property of the Dumet wire and glass used for the glass sealed diode as set forth in the claimed invention. Even if Sugimoto were to disclose such features, one skilled in the art would not be motivated to combine the teachings of Ochi with those of Robinson and Sugimoto because they are in different fields of endeavor.

It is therefore respectfully submitted that claims 5 and 21 are allowable over the art of record.

Claim 6 was rejected under 35 USC §103(a) as being unpatentable over Ochi in view of Sugimoto. Regarding this rejection, the Office Action alleges that Ochi discloses all the features of independent claim 1. Sugimoto is relied upon for teaching a glass sealing member which is softened and sealed at a temperature within 500 °C to 1000 °C.

As previously discussed, Ochi fails to provide any disclosure or suggestion for features recited in independent claim 1. Additionally, Sugimoto fails to provide any disclosure or suggestion for the features that are lacking in Ochi. Ochi and Sugimoto also do not appear to be properly combinable because they are in different fields of endeavor. Accordingly, claim 6 is believed allowable over the art of record.

Claim 18 was rejected under 35 USC §103(a) as being unpatentable over Ochi in view of Inazawa.

The cancellation of claim 18 renders this particular ground of rejection moot.

Claims 19 and 20 were rejected under 35 USC §103(a) as being unpatentable over Ochi in view of Einthoven. Regarding this rejection, the Office Action alleges that Ochi teaches all the limitations of independent claim 1. Einthoven is relied upon for teaching a semiconductor element that comprises a Schottky barrier diode having a semiconductor substrate, and an epitaxial layer formed on the semiconductor substrate, and a metal electrode formed on the epitaxial layer having a tungsten film.

As previously discussed, Ochi fails to provide any disclosure or suggestion for features that are explicitly recited in independent claim 1. The inclusion of Einthoven as a secondary reference does not remedy this particular failure, because Einthoven

also fails to provide any disclosure or suggestion for features recited in independent claim 1, from which claims 19 and 20 depend.

It is therefore respectfully submitted that independent claims 19 and 20 are allowable over the art of record.

V. Conclusion

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 843.43729X00).

Respectfully submitted,
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